# Work Order ID 75641

*October-27-11 11:41:47 AM*

*75641*



**Item ID:** D6009-129 **Accept** *N900040100* **Setup Start** *NS1*

**Revision ID:** **Stop** *NS2*

**Item Name:** Crosstube Material

**Start Date:** 27/10/2011 **Start Qty:** 20.00 *20* 21X

**Required Date:** 30/07/2013 **Req'd Qty:** 20.00 *20*

**Reference:**

**Cust Item ID:**

**Customer:**

**Approvals:** **Process Plan:** M.L.J **Date:** 11/10/27 **Tooling:** _____ **Date:** _____ **Run Start** *NR1*

**QC:** _____ **Date:** _____ **SPC (Y/N):** _____ **Date:** _____ **Stop** *NR2*

| Sequence ID/ Work Center ID | Operation Description | Set Up/ Run Hours | Tool ID | Tool # | Plan Code | Accept Qty | Reject Qty | Reject Number | Insp. Stamp |
|---|---|---|---|---|---|---|---|---|---|

| Draw Nbr | Revision Nbr |
|---|---|
| D6009 | Rev A |

100 0.00

*100*

Purchasing

Purchasing PURCHASING

CL 11/11/03 20

**Memo** 0.00

Issue P/O: 15350

a) Order as per Dwg D6009

b) Material: 3.500 x 0.625 wall 7075-T6/T6511 (WW-T-700/7 or QQ-A-225/9 or QQ-A-200/11) seamless aluminum tube

c) Minimum ultimate tensile strength = 77 ksi

d) Minimum tensile yield strength = 66 ksi

e) Tolerance are per ASTM B210 (see details on Dwg D6009)

f) Material certification required

110 Receive & Inspect for Damage & Mat'l Certs 0.00

*110*

Packaging

Packaging

21X _____ _____ 13-5-30

**Memo** 0.00

Ensure material certification is attached

**Dart Aerospace Ltd**

| W/O: | | WORK ORDER CHANGES | | | | | |
|---|---|---|---|---|---|---|---|
| **DATE** | **STEP** | **PROCEDURE CHANGE** | **By** | **Date** | **Qty** | **Approval** Chief Eng / Prod Mgr | **Approval** QC Inspector |
| | | | | | | | |
| | | | | | | | |

**Part No:** _____ **PAR #:** _____ **Fault Category:** _____ **NCR:** Yes No **DQA:** _____ **Date:** _____

**Resolution:** _____ **Disposition:** _____ **QA: N/C Closed:** _____ **Date:** _____

| NCR: | | WORK ORDER NON-CONFORMANCE (NCR) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **DATE** | **STEP** | **Description of NC** Section A | **Corrective Action** Section B | | | **Verification** Section C | **Approval** Chief Eng | **Approval** QC Inspector |
| | | | **Initial** Chief Eng | **Action Description** Chief Eng | **Sign & Date** | | | |
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**NOTE:** Date & initial all entries

**Item ID:** D6009-129 **Accept** *N900040100* **Setup Start** *NS1*
**Revision ID:** **Stop** *NS2*
**Item Name:** Crosstube Material
**Start Date:** 27/10/2011 **Start Qty:** 20.00 *20*
**Required Date:** 30/07/2013 **Req'd Qty:** 20.00 *20*
**Reference:**
**Cust Item ID:**
**Customer:**

**Approvals:** **Process Plan:** _____ **Date:** _____ **Tooling:** _____ **Date:** _____
**QC:** _____ **Date:** _____ **SPC (Y/N):** _____ **Date:** _____

**Run Start** *NR1*
**Stop** *NR2*

| Sequence ID/ Work Center ID | Operation Description | Set Up/ Run Hours | Tool ID | Tool # | Plan Code | Accept Qty | Reject Qty | Reject Number | Insp. Stamp |
|---|---|---|---|---|---|---|---|---|---|
| 120 | QC6- Inspect dimensions to drawing | 0.00 | | | | | | | |
| *120* QC Quality Control | **Memo** Ensure Material certification comply to Dwg D6009 | 0.00 | DAS 16 2-59 13/05/31 | | | | | | |
| 140 | Identify as per dwg & Stock Location: L/C | 0.00 | | | | | | | |
| *140* Packaging Packaging | **Memo** | 0.00 | | | | | | | |
| 150 | QC21- Final Inspection - Work Order Release | 0.00 | | | | | | | |
| *150* QC Quality Control | **Memo** | 0.00 | | | | | | | |

13/06/03

13/6/4

pl 13/06/4

**Dart Aerospace Ltd**

| W/O: | | WORK ORDER CHANGES | | | | | |
|---|---|---|---|---|---|---|---|
| **DATE** | **STEP** | **PROCEDURE CHANGE** | **By** | **Date** | **Qty** | **Approval** Chief Eng / Prod Mgr | **Approval** QC Inspector |
| | | | | | | | |
| | | | | | | | |

**Part No:** _____ **PAR #:** _____ **Fault Category:** _____ **NCR:** Yes No **DQA:** _____ **Date:** _____

**Resolution:** _____ **Disposition:** _____ **QA: N/C Closed:** _____ **Date:** _____

| NCR: | | WORK ORDER NON-CONFORMANCE (NCR) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **DATE** | **STEP** | **Description of NC** Section A | **Corrective Action** Section B | | | **Verification** Section C | **Approval** Chief Eng | **Approval** QC Inspector |
| | | | **Initial** Chief Eng | **Action Description** Chief Eng | **Sign & Date** | | | |
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**NOTE:** Date & initial all entries

# Picklist Print

*October-27-11 11:41:51 AM*



**Work Order ID:** 75641 *75641*

**Parent Item:** D6009-129 *D6009-129*

**Parent Item Name:** Crosstube Material

**Start Date:** 27/10/2011 **Required Date:** 30/07/2013

**Start Qty:** 20.00 **Required Qty:** 20.00

**Comments:** IPP Rev:A01.08.17New IssueSM IPP Rev:B remove
alodine DD 10.01.09 verified by:JLM

| Component Item ID/ Item Name | Replacement Item ID | Mfg/ Purch | Bin Item | Primary Location | Last Location | Route Seq ID | Unit of Measure | Qty on Hand | Qty per Kit | Total Qty | Qty Issued | Date Issued | Status |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D6009-129P *D6009-129P* Crosstube Material | | Purchased | No | | | 110 | Each | 0.0000 | 1 ** | 20 | | | |

**Dart Aerospace Ltd**

| W/O: | | WORK ORDER CHANGES | | | | | |
|---|---|---|---|---|---|---|---|
| **DATE** | **STEP** | **PROCEDURE CHANGE** | **By** | **Date** | **Qty** | **Approval** Chief Eng / Prod Mgr | **Approval** QC Inspector |
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**Part No:** _____ **PAR #:** _____ **Fault Category:** _____ **NCR:** Yes No **DQA:** _____ **Date:** _____

**Resolution:** _____ **Disposition:** _____ **QA: N/C Closed:** _____ **Date:** _____

| NCR: | | WORK ORDER NON-CONFORMANCE (NCR) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **DATE** | **STEP** | **Description of NC** Section A | **Corrective Action** Section B | | | **Verification** Section C | **Approval** Chief Eng | **Approval** QC Inspector |
| | | | **Initial** Chief Eng | **Action Description** Chief Eng | **Sign & Date** | | | |
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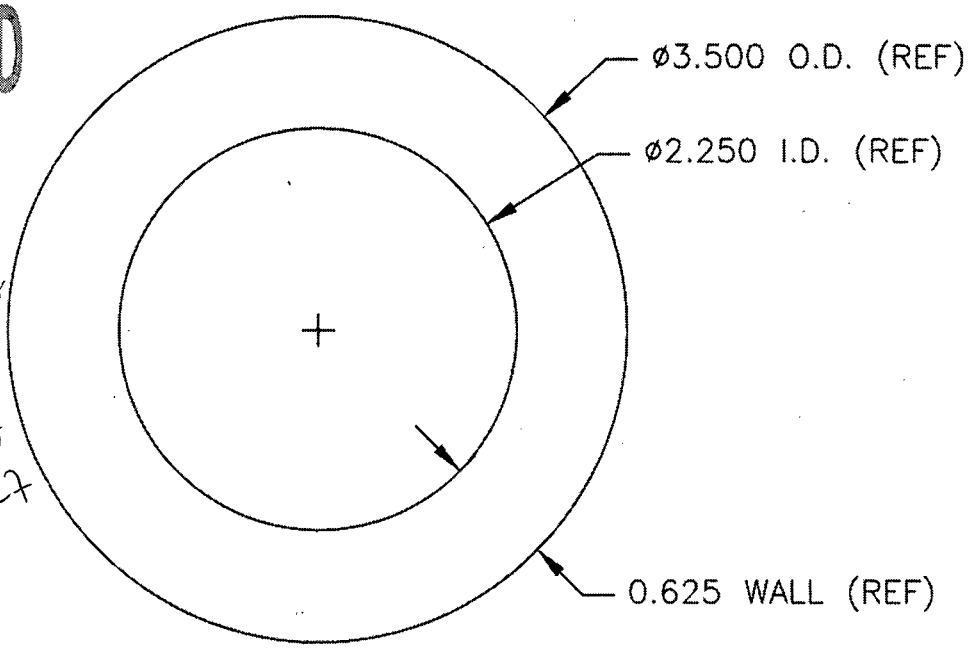
**NOTE:** Date & initial all entries

| | | | |
|---|---|---|---|
| DESIGN | DRAWN BY | DART AEROSPACE LTD<br>HAWKESBURY, ONTARIO, CANADA | |
| CHECKED | APPROVED | DRAWING NO. D6009 | REV. A<br>SHEET 1 OF 1 |
| DATE 01.08.16 | | TITLE CROSSTUBE MATERIAL | SCALE 1:1 |
| A | 01.08.16 | NEW ISSUE | |

# SPECIFICATION CONTROL DRAWING

RELEASED
01.08.17

SHOP COPY
RETURN TO
ENGINEERING
UNCONTROLLED COPY
SUBJECT TO AMENDMENT
WITHOUT NOTICE
WORK ORDER
NO. 75641
M.L.J
11/10/27




NOTES

1) D6009–XXX CROSSTUBE
LENGTH

WHERE XXX IS LENGTH IN INCHES
EG. 129" LONG TUBE: D6009–129

2) MATERIAL: 3.500 OD x 0.625 WALL 7075–T6/T6511 (WW–T–700/7 OR QQ–A–225/9 OR QQ–A–200/11) SEAMLESS ALUMINUM TUBE.
MINIMUM ULTIMATE TENSILE STRENGTH = 77 ksi
MINIMUM YIELD TENSILE STRENGTH = 66 ksi
3) TOLERANCES ARE PER ASTM B210 AS FOLLOWS:
O.D.: ± 0.008 MEAN (±0.016 INCLUDING OVALITY)
WALL: ±0.020 MEAN (±0.063 INCLUDING ECCENTRICITY)
LENGTH: XXX +0.188/–0.000
STRAIGHTNESS: 0.010" DEVIATION / 12" LENGTH
4) EXTREME CARE MUST BE TAKEN TO PROTECT THE OUTSIDE SURFACE OF THE TUBE. THE OUTSIDE SURFACE MUST BE SMOOTH AND FREE FROM SURFACE DEFECTS SUCH AS SCRATCHES, NICKS, OR DENTS. DEFECTS UP TO 0.005" MAY BE BLENDED OUT LONGITUDINALLY. CIRCUMFERENTIAL GRIND MARKS ARE UNACCEPTABLE.
5) CHEMICAL CONVERSION COAT PER DART QSI 005 4.1

**Dart Aerospace Ltd**

| W/O: | | WORK ORDER CHANGES | | | | | |
|---|---|---|---|---|---|---|---|
| **DATE** | **STEP** | **PROCEDURE CHANGE** | **By** | **Date** | **Qty** | **Approval** Chief Eng / Prod Mgr | **Approval** QC Inspector |
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**Part No:** _____ **PAR #:** _____ **Fault Category:** _____ **NCR:** Yes No **DQA:** _____ **Date:** _____

**Resolution:** _____ **Disposition:** _____ **QA: N/C Closed:** _____ **Date:** _____

| NCR: | | WORK ORDER NON-CONFORMANCE (NCR) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **DATE** | **STEP** | **Description of NC** Section A | **Corrective Action** Section B | | | **Verification** Section C | **Approval** Chief Eng | **Approval** QC Inspector |
| | | | **Initial** Chief Eng | **Action Description** Chief Eng | **Sign & Date** | | | |
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**NOTE:** Date & initial all entries

# Packinglist ALUnna AG

| | |
|---|---|
| ALUnna ref. no. | 44993/200 |
| Customer PO. | PO. 15350 |
| Date: | 04.29.13 |

**Boxmarking:**

| |
|---|
| Dart Aerospace PO. 15350 D 6009-129 |
| Made in Germany |
| Dest. Hawkesbury Ont. Canada |

**We hereby declare that the wooden packing material are totally free from bark and apparently free from live plant pests**

| Item no. | Box no. | OD (inch) | ID (inch) | Wall (inch) | Net Weight (lbs) | Tare lbs | Gross Weight | Pieces | lengths (ft) | Boxdimension Lengths (inch) | Width (inch) | height (inch) | Cast. / Heat No. Top | Pcs. | Cast. / Heat No. Middle | Pcs. | Cast. / Heat No. Bottom |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 1 | 3,500 | 2,250 | 0,625 | 1550 | 278 | 1828 | 21 | 11 | 151,575 | 22,441 | 22,441 | | | 84610/1302304 | 21 | |
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| | | | | | 1550 | 278 | 1828 | 21 | | 1,251 m³ | | | | | | | |

S:\VERSAND\USA_Packliste\44993_200

# Abnahmeprüfzeugnis 3.1 - DIN EN 10204:2005

*Inspection Certificate 3.1 - DIN EN 10204:2005 / Certificat de Reception 3.1- DIN EN 10204:2005*

**Kunde:** *Client:* Dart Aerospace Ltd.

1270 Aberdeen Street
K6A1K7 Hawkesbury, ON Canada

**Zeugnisnummer:** *Cert No.: / No. du certificat:* 373/13

**Bestellnummer:** *Order No. / No. de commande* PO 15350

**Auftrag:** *Our Reference/Notre Reference:* 44993/200

**Produkt:** *Product / Produit:* Rohre nahtlos gepresst
*Tubes seamless extruded*

**Spezifikation:** *Specification:* AMS - QQ - A - 200/11; Spezifikation Dart Aerospace D6009

**Werkstoff:** *Alloy/Alliage:* 7075

**Zustand:** *Temper/État* T 6511

**Abmessung** *Size / Dimension* 3,500 INCH x 2,250 INCH x 0,625 INCH x 129,000 INCH
D6009-129 3.500 X 0.625 X 129

**Kennzeichnung** *Marking/Marquage:* ALUnna - Cert No. 373/13 - 7075 - T6511 - Cast No. 84610 - AMS QQA. 200/11 - 3.500" OD X 0.625" Wall - Heat Lot No. 1302304 - ALUnna Order Conf. No. 44993/200-1. PO. 15350

**Lieferung** *Delivered Material / Matérial délivre:* pcs. 21 lbs 1550

**Country of Manufacture: Germany**

Products are in accordance with applicable RoHS

## 1. Chemische Analyse — *Chemical Analysis / analyse chimique*

Other elements each max. 0,05 %, total 0,15 %

| | | Si | Fe | Cu | Mn | Mg | Cr | Zn | Ti | Pb | Zr | Bi | Sn | Ni |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Charge/ Cast No. | min. | | | 1,2 | | 2,1 | 0,18 | 5,1 | | | | | | |
| | max. | 0,40 | 0,50 | 2,0 | 0,30 | 2,9 | 0,28 | 6,1 | 0,20 | | | | | |
| 84610 | | 0,04 | 0,11 | 1,46 | 0,02 | 2,44 | 0,19 | 5,75 | 0,04 | 0,01 | 0,01 | | | 0,0002 |

**Hydrogen content:** 0,14 **ccm/100 g Al** Elements without indication < 0,01 %

**country of melt manufacturer: Germany**

## 2. Mechanische Eigenschaften — *Mechanical Properties / Valeurs Mécaniques*

| Anforderungen Requirements | tensile (Rm) ksi | yield (Rp0,2) ksi | elongation 2" % | elongation A % | Hardness HB | Heat Lot No. |
|---|---|---|---|---|---|---|
| min. | 77,0 | 66,0 | 7,0 | | | |
| max. | | | | | | |
| 1 | 85,840 | 78,445 | 11,0 | | | 1302304 |
| 2 | 87,000 | 79,460 | 11,0 | | | |
| 3 | 86,275 | 78,445 | 11,0 | | | |

RMS: outside 25 - max. 15,0 µ"

**Ergebnis der Prüfungen:** Es wird bestätigt, daß die Lieferung geprüft wurde und den Vereinbarungen bei der Bestellannahme entspricht

*Test results:* We confirm that the delivery has been tested and applies to the agreements made on receipt of the order

*Resultats:* Nous confirmons que la livraison a été controlée et correspond avec les conventions faites à la réception de la commande

mergärdtri

25.03.2013

Certified acc. DIN EN ISO 9001:2008 and DIN EN 9100:2003
valid until 2013-11-10
Cert.- Reg. No.: 001959 QM08; 001959 ASH

ALUnna

Abnahmebeauftragter

Dart Aerospace Ltd.
1270 Aberdeen Street
Hawkesbury, ON K6A 1K7
Tel: 613 632 9577
Fax: 613 632 1053

# PURCHASE ORDER

**Purchase Order ID PO15350**

**Purchase Order Date** 11/03/11
**PO Print Date** 12/07/11



**Order From :** VU-ALU001

ALUMINIUMWERK UNNA AG
630 3033 SOUTH PARKER RD
AURORA, CO 80014
USA

| | | | |
|---|---|---|---|
| **Contact Name** | | **Buyer** | Chantal Lavoie |
| **Vendor Phone** | 303 755 5672 | **Requisition Nbr** | |
| **Vendor Fax** | 303 755 5936 | **Tax Resale Nbr** | 10127-2607 |
| **Vendor Account Nbr** | | **Terms** | Net 30 |
| | | **Currency** | USD |
| | | **FOB** | Destination-Collect |

**Ship To :** DART AEROSPACE LTD 1270 ABERDEEN
HAWKESBURY, ON K6A 1K7
CANADA

RELISED

| Line Nbr | Reference / Revision ID / Vendor Part Number | Description/ Mfg ID | Req Date/ Taxable | Req Qty/ Unit of Measure | Ship Method | Unit Price | Extended Price |
|---|---|---|---|---|---|---|---|
| 1 | D6010-115P | Crosstube Material | 4/30/13 Yes | 20.00 Each | | $336.0000 | $6,720.00 |

**Special Inst:** AS PER DWG D6010 REV. A
B75640
MATERIAL: 7075-T6/T6511 AS PER WW-T-700/7 OR
QQ-A-200/11 OR QQ-A-225/9 SEAMLESS TUBE
MINIMUM ULTIMATE TENSILE STRENGTH = 77 KSI
MINIMUM TENSILE YIELD STRENGTH = 66 KSI
SIZE: 2.250" OD X 0.320" WALL X 115" LONG

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2 | D6009-129P | Crosstube Material | 4/30/13 Yes | 20.00 Each | | $996.0000 | $19,920.00 |

recu 21x SP13-5-2

No substitution or deviation without consent.
Certificate of Conformity or Material Certification required when applicable

**Change Nbr:** 2 **Change Date:** 12/07/11

# EXTRUSION INSPECTION SHEET

| | | SIDE A | SIDE B | | | | | ULTRA SONIC MEASURMENTS | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TUBE # | TOTAL LENGTH | DIA two readings | DIA two readings | INSIDE DIA | wall thickness measured w/vern | Strightness at 12"in middle | Rockwell Reading | LOCATION on tube | R1 | R2 | R3 | R4 |
| DWG | 129.00" | 3.500" | | 2.250" | 0.625" | 0.010" | N/A | Middle | N/A | | | |
| 1 | 129.00" | 3.502"/3.497" | 3.501"/3.496" | 2.251" | 0.628"/0.611" | 0.003" | N/A | Middle | 0.618" | 0.610" | 0.622" | 0.640" |
| 2 | 129.00" | 3.503"/3.499" | 3.499"/3.492" | 2.251" | 0.624"/0.619" | 0.0045" | N/A | Middle | 0.617" | 0.605" | 0.620" | 0.640" |
| 3 | 129.00" | 3.501"/3.497" | 3.497"/3.493" | 2.256" | 0.627"/0.607" | 0.006" | N/A | Middle | 0.627" | 0.625" | 0.617" | 0.614" |
| 4 | 129.00" | 3.502"/3.496" | 3.497"/3.491" | 2.249" | 0.655"/0.604" | 0.0065" | N/A | Middle | 0.615" | 0.633" | 0.640" | 0.607" |
| 5 | 129.00" | 3.492"/3.489" | 3.497"/3.493" | 2.246" | 0.651"/0.599" | 0.009" | N/A | Middle | 0.632" | 0.630" | 0.610" | 0.610" |
| 6 | 129.00" | 3.499"/3.495" | 3.491"/3.490" | 2.244" | 0.630"/0.615" | 0.004" | N/A | Middle | 0.600" | 0.618" | 0.640" | 0.623" |
| 7 | 129.00" | 3.497"/3.495" | 3.494"/3.492" | 2.243" | 0.629"/0.600" | 0.003" | N/A | Middle | 0.617" | 0.611" | 0.617" | 0.631" |
| 8 | 129.00" | 3.494"/3.491" | 3.495"/3.490" | 2.241" | 0.650"/0.608" | 0.0045" | N/A | Middle | 0.623" | 0.605" | 0.622" | 0.638" |
| 9 | 129.00" | 3.499"/3.495" | 3.496"/3.492" | 2.247" | 0.637"/0.616" | 0.002" | N/A | Middle | 0.605" | 0.633" | 0.641" | 0.615" |
| 10 | 129.00" | 3.496"/3.493" | 3.490"/3.487" | 2.245" | 0.630"/0.618" | 0.004" | N/A | Middle | 0.632" | 0.625" | 0.615" | 0.616" |
| 11 | | | | | | | N/A | Middle | | | | |
| 12 | | | | | | | N/A | Middle | | | | |
| 13 | | | | | | | N/A | Middle | | | | |
| 14 | | | | | | | N/A | Middle | | | | |
| 15 | | | | | | | N/A | Middle | | | | |
| PART # D6009-129 | | P/O# 15350 | | | BATCH # B75641 | | | Notes: | | | | |

**MEAN OUTSIDE DIAMETER PERMISSIBLE +- 0.006 side A**

| Tube # | Actual A | Actual B | Mean | Nominal | Tolerance | min allowable dimension | max allowable dimension | Results for min allowable | Results for max allowable |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 3.502 | 3.497 | 3.500 | 3.500 | 0.006 | 3.494 | 3.506 | 0.005 | -0.006 |
| 2 | 3.503 | 3.499 | 3.501 | 3.500 | 0.006 | 3.494 | 3.506 | 0.007 | -0.005 |
| 3 | 3.501 | 3.497 | 3.499 | 3.500 | 0.006 | 3.494 | 3.506 | 0.005 | -0.007 |
| 4 | 3.502 | 3.496 | 3.499 | 3.500 | 0.006 | 3.494 | 3.506 | 0.005 | -0.007 |
| 5 | 3.492 | 3.489 | 3.491 | 3.500 | 0.006 | 3.494 | 3.506 | -0.004 | -0.015 |
| 6 | 3.499 | 3.495 | 3.497 | 3.500 | 0.006 | 3.494 | 3.506 | 0.003 | -0.009 |
| 7 | 3.497 | 3.495 | 3.496 | 3.500 | 0.006 | 3.494 | 3.506 | 0.002 | -0.010 |
| 8 | 3.494 | 3.491 | 3.493 | 3.500 | 0.006 | 3.494 | 3.506 | -0.002 | -0.013 |
| 9 | 3.499 | 3.495 | 3.497 | 3.500 | 0.006 | 3.494 | 3.506 | 0.003 | -0.009 |
| 10 | 3.496 | 3.493 | 3.495 | 3.500 | 0.006 | 3.494 | 3.506 | 0.000 | -0.011 |
| 11 | | | #DIV/0! | | 0.006 | -0.006 | 0.006 | #DIV/0! | #DIV/0! |
| 12 | | | #DIV/0! | | 0.006 | -0.006 | 0.006 | #DIV/0! | #DIV/0! |
| 13 | | | | | | | | | |
| 14 | | | | | | | | | |
| 15 | | | | | | | | | |
| 16 | | | | | | | | | |

**MEAN OUTSIDE DIAMETER PERMISSIBLE +- 0.006 Side B**

| Tube # | Actual A | Actual B | Mean | Nominal | Tolerance | min allowable dimension | max allowable dimension | Results for min allowable | Results for max allowable |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 3.501 | 3.496 | 3.499 | 3.500 | 0.006 | 3.494 | 3.506 | 0.004 | -0.007 |
| 2 | 3.499 | 3.492 | 3.496 | 3.500 | 0.006 | 3.494 | 3.506 | 0.001 | -0.011 |
| 3 | 3.497 | 3.493 | 3.495 | 3.500 | 0.006 | 3.494 | 3.506 | 0.001 | -0.011 |
| 4 | 3.497 | 3.491 | 3.494 | 3.500 | 0.006 | 3.494 | 3.506 | 0.000 | -0.012 |
| 5 | 3.497 | 3.493 | 3.495 | 3.500 | 0.006 | 3.494 | 3.506 | 0.001 | -0.011 |
| 6 | 3.491 | 3.490 | 3.491 | 3.500 | 0.006 | 3.494 | 3.506 | -0.004 | -0.015 |
| 7 | 3.494 | 3.492 | 3.493 | 3.500 | 0.006 | 3.494 | 3.506 | -0.001 | -0.013 |
| 8 | 3.495 | 3.490 | 3.493 | 3.500 | 0.006 | 3.494 | 3.506 | -0.002 | -0.013 |
| 9 | 3.496 | 3.492 | 3.494 | 3.500 | 0.006 | 3.494 | 3.506 | 0.000 | -0.012 |
| 10 | 3.490 | 3.487 | 3.489 | 3.500 | 0.006 | 3.494 | 3.506 | -0.006 | -0.017 |
| 11 | | | #DIV/0! | | 0.006 | -0.006 | 0.006 | #DIV/0! | #DIV/0! |
| 12 | | | #DIV/0! | | 0.006 | -0.006 | 0.006 | #DIV/0! | #DIV/0! |
| 13 | | | | | | | | | |
| 14 | | | | | | | | | |
| 15 | | | | | | | | | |
| 16 | | | | | | | | | |

**OUTSIDE DIA. Permissible (with Ovality) +- 0.012 side A**

| Tube # | Actual A | Nominal | Tolerance | min allowable dimension | max allowable dimension | Results for min allowable | Results for max allowable |
|---|---|---|---|---|---|---|---|
| 1 | 3.502 | 3.500 | 0.012 | 3.488 | 3.512 | 0.014 | -0.010 |
| 2 | 3.503 | 3.500 | 0.012 | 3.488 | 3.512 | 0.015 | -0.009 |
| 3 | 3.501 | 3.500 | 0.012 | 3.488 | 3.512 | 0.013 | -0.011 |
| 4 | 3.502 | 3.500 | 0.012 | 3.488 | 3.512 | 0.014 | -0.010 |
| 5 | 3.492 | 3.500 | 0.012 | 3.488 | 3.512 | 0.004 | -0.020 |
| 6 | 3.499 | 3.500 | 0.012 | 3.488 | 3.512 | 0.011 | -0.013 |
| 7 | 3.497 | 3.500 | 0.012 | 3.488 | 3.512 | 0.009 | -0.015 |
| 8 | 3.494 | 3.500 | 0.012 | 3.488 | 3.512 | 0.006 | -0.018 |
| 9 | 3.499 | 3.500 | 0.012 | 3.488 | 3.512 | 0.011 | -0.013 |
| 10 | 3.496 | 3.500 | 0.012 | 3.488 | 3.512 | 0.008 | -0.016 |
| 11 | | | 0.012 | -0.012 | 0.012 | 0.012 | -0.012 |
| 12 | | | 0.012 | -0.012 | 0.012 | 0.012 | -0.012 |
| 13 | | | | | | | |
| 14 | | | | | | | |
| 15 | | | | | | | |
| 16 | | | | | | | |

**OUTSIDE DIA. Permissible (with Ovality) +- 0.012 side b**

| Tube # | Actual A | Nominal | Tolerance | min allowable dimension | max allowable dimension | Results for min allowable | Results for max allowable |
|---|---|---|---|---|---|---|---|
| 1 | 3.501 | 3.500 | 0.012 | 3.488 | 3.512 | 0.013 | -0.011 |
| 2 | 3.499 | 3.500 | 0.012 | 3.488 | 3.512 | 0.011 | -0.013 |
| 3 | 3.497 | 3.500 | 0.012 | 3.488 | 3.512 | 0.009 | -0.015 |
| 4 | 3.497 | 3.500 | 0.012 | 3.488 | 3.512 | 0.009 | -0.015 |
| 5 | 3.497 | 3.500 | 0.012 | 3.488 | 3.512 | 0.009 | -0.015 |
| 6 | 3.491 | 3.500 | 0.012 | 3.488 | 3.512 | 0.003 | -0.021 |
| 7 | 3.494 | 3.500 | 0.012 | 3.488 | 3.512 | 0.006 | -0.018 |
| 8 | 3.495 | 3.500 | 0.012 | 3.488 | 3.512 | 0.007 | -0.017 |
| 9 | 3.496 | 3.500 | 0.012 | 3.488 | 3.512 | 0.008 | -0.016 |
| 10 | 3.490 | 3.500 | 0.012 | 3.488 | 3.512 | 0.002 | -0.022 |
| 11 | | | 0.012 | -0.012 | 0.012 | 0.012 | -0.012 |
| 12 | | | 0.012 | -0.012 | 0.012 | 0.012 | -0.012 |
| 13 | | | | | | | |
| 14 | | | | | | | |
| 15 | | | | | | | |
| 16 | | | | | | | |

**OUTSIDE DIA. Permissible (with Ovality) +- 0.012 side A**

| Tube # | Actual B | Nominal | Tolerance | min allowable dimension | max allowable dimension | Results for min allowable | Results for max allowable |
|---|---|---|---|---|---|---|---|
| 1 | 3.497 | 3.500 | 0.012 | 3.488 | 3.512 | 0.009 | -0.015 |
| 2 | 3.499 | 3.500 | 0.012 | 3.488 | 3.512 | 0.011 | -0.013 |
| 3 | 3.497 | 3.500 | 0.012 | 3.488 | 3.512 | 0.009 | -0.015 |
| 4 | 3.496 | 3.500 | 0.012 | 3.488 | 3.512 | 0.008 | -0.016 |
| 5 | 3.489 | 3.500 | 0.012 | 3.488 | 3.512 | 0.001 | -0.023 |
| 6 | 3.495 | 3.500 | 0.012 | 3.488 | 3.512 | 0.007 | -0.017 |
| 7 | 3.495 | 3.500 | 0.012 | 3.488 | 3.512 | 0.007 | -0.017 |
| 8 | 3.491 | 3.500 | 0.012 | 3.488 | 3.512 | 0.003 | -0.021 |
| 9 | 3.495 | 3.500 | 0.012 | 3.488 | 3.512 | 0.007 | -0.017 |
| 10 | 3.493 | 3.500 | 0.012 | 3.488 | 3.512 | 0.005 | -0.019 |
| 11 | | | 0.012 | -0.012 | 0.012 | 0.012 | -0.012 |
| 12 | | | 0.012 | -0.012 | 0.012 | 0.012 | -0.012 |
| 13 | | | | | | | |
| 14 | | | | | | | |
| 15 | | | | | | | |
| 16 | | | | | | | |

**OUTSIDE DIA. Permissible (with Ovality) +- 0.012 side b**

| Tube # | Actual B | Nominal | Tolerance | min allowable dimension | max allowable dimension | Results for min allowable | Results for max allowable |
|---|---|---|---|---|---|---|---|
| 1 | 3.496 | 3.500 | 0.012 | 3.488 | 3.512 | 0.008 | -0.016 |
| 2 | 3.492 | 3.500 | 0.012 | 3.488 | 3.512 | 0.004 | -0.020 |
| 3 | 3.493 | 3.500 | 0.012 | 3.488 | 3.512 | 0.005 | -0.019 |
| 4 | 3.491 | 3.500 | 0.012 | 3.488 | 3.512 | 0.003 | -0.021 |
| 5 | 3.493 | 3.500 | 0.012 | 3.488 | 3.512 | 0.005 | -0.019 |
| 6 | 3.490 | 3.500 | 0.012 | 3.488 | 3.512 | 0.002 | -0.022 |
| 7 | 3.492 | 3.500 | 0.012 | 3.488 | 3.512 | 0.004 | -0.020 |
| 8 | 3.490 | 3.500 | 0.012 | 3.488 | 3.512 | 0.002 | -0.022 |
| 9 | 3.492 | 3.500 | 0.012 | 3.488 | 3.512 | 0.004 | -0.020 |
| 10 | 3.487 | 3.500 | 0.012 | 3.488 | 3.512 | -0.001 | -0.025 |
| 11 | | | 0.012 | -0.012 | 0.012 | 0.012 | -0.012 |
| 12 | | | 0.012 | -0.012 | 0.012 | 0.012 | -0.012 |
| 13 | | | | | | | |
| 14 | | | | | | | |
| 15 | | | | | | | |
| 16 | | | | | | | |

end measuement with vern

| Mean OUTSIDE DIA. Permissible +- 0.015 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Tube | Actual A | Actual B | Mean | Nominal | Tolerance | min | max | min | max |
| 1 | **0.628** | **0.611** | **0.620** | **0.625** | **0.015** | **0.610** | **0.640** | **0.0095** | **-0.021** |
| 2 | **0.624** | **0.619** | **0.622** | **0.625** | **0.015** | **0.610** | **0.640** | **0.0115** | **-0.019** |
| 3 | **0.627** | **0.607** | **0.617** | **0.625** | **0.015** | **0.610** | **0.640** | **0.007** | **-0.023** |
| 4 | **0.655** | **0.604** | **0.630** | **0.625** | **0.015** | **0.610** | **0.640** | **0.0195** | **-0.011** |
| 5 | **0.651** | **0.599** | **0.625** | **0.625** | **0.015** | **0.610** | **0.640** | **0.015** | **-0.015** |
| 6 | **0.630** | **0.615** | **0.623** | **0.625** | **0.015** | **0.610** | **0.640** | **0.0125** | **-0.018** |
| 7 | **0.629** | **0.600** | **0.615** | **0.625** | **0.015** | **0.610** | **0.640** | **0.0045** | **-0.026** |
| 8 | **0.650** | **0.608** | **0.629** | **0.625** | **0.015** | **0.610** | **0.640** | **0.019** | **-0.011** |
| 9 | **0.637** | **0.616** | **0.627** | **0.625** | **0.015** | **0.610** | **0.640** | **0.0165** | **-0.014** |
| 10 | **0.630** | **0.618** | **0.624** | **0.625** | **0.015** | **0.610** | **0.640** | **0.014** | **-0.016** |
| 11 | | | #DIV/0! | | 0.015 | -0.015 | 0.015 | #DIV/0! | #DIV/0! |
| 12 | | | #DIV/0! | | 0.015 | -0.015 | 0.015 | #DIV/0! | #DIV/0! |
| 13 | | | #DIV/0! | | 0.015 | -0.015 | 0.015 | #DIV/0! | #DIV/0! |
| 14 | | | #DIV/0! | | 0.015 | -0.015 | 0.015 | #DIV/0! | #DIV/0! |
| 15 | | | #DIV/0! | | 0.015 | -0.015 | 0.015 | #DIV/0! | #DIV/0! |

| OUTSIDE DIA. Permissible +- 0.038 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Tube | Actual A | Actual B | Nominal | Tolerance | min | max | min | max |
| 1 | **0.628** | **0.611** | **0.625** | **0.038** | **0.587** | **0.663** | **0.041** | **-0.052** |
| 2 | **0.624** | **0.619** | **0.625** | **0.038** | **0.587** | **0.663** | **0.037** | **-0.044** |
| 3 | **0.627** | **0.607** | **0.625** | **0.038** | **0.587** | **0.663** | **0.040** | **-0.056** |
| 4 | **0.655** | **0.604** | **0.625** | **0.038** | **0.587** | **0.663** | **0.068** | **-0.059** |
| 5 | **0.651** | **0.599** | **0.625** | **0.038** | **0.587** | **0.663** | **0.064** | **-0.064** |
| 6 | **0.630** | **0.615** | **0.625** | **0.038** | **0.587** | **0.663** | **0.043** | **-0.048** |
| 7 | **0.629** | **0.600** | **0.625** | **0.038** | **0.587** | **0.663** | **0.042** | **-0.063** |
| 8 | **0.650** | **0.608** | **0.625** | **0.038** | **0.587** | **0.663** | **0.063** | **-0.055** |
| 9 | **0.637** | **0.616** | **0.625** | **0.038** | **0.587** | **0.663** | **0.050** | **-0.047** |
| 10 | **0.630** | **0.618** | **0.625** | **0.038** | **0.587** | **0.663** | **0.043** | **-0.045** |
| 11 | | | | 0.038 | -0.038 | 0.038 | 0.038 | -0.038 |
| 12 | | | | 0.038 | -0.038 | 0.038 | 0.038 | -0.038 |
| 13 | | | | 0.038 | -0.038 | 0.038 | 0.038 | -0.038 |
| 14 | | | | 0.038 | -0.038 | 0.038 | 0.038 | -0.038 |
| 15 | | | | 0.038 | -0.038 | 0.038 | 0.038 | -0.038 |

center measurment with ultra sonic

| Mean OUTSIDE DIA. Permissible +- 0.015 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Tube | highest | lowest | Mean | Nominal | Tolerance | min | max | min | max |
| 1 | **0.640** | **0.610** | **0.625** | **0.625** | **0.015** | **0.610** | **0.640** | **0.015** | **-0.015** |
| 2 | **0.640** | **0.605** | **0.623** | **0.625** | **0.015** | **0.610** | **0.640** | **0.0125** | **-0.018** |
| 3 | **0.627** | **0.614** | **0.621** | **0.625** | **0.015** | **0.610** | **0.640** | **0.0105** | **-0.020** |
| 4 | **0.640** | **0.607** | **0.624** | **0.625** | **0.015** | **0.610** | **0.640** | **0.0135** | **-0.017** |
| 5 | **0.632** | **0.610** | **0.621** | **0.625** | **0.015** | **0.610** | **0.640** | **0.011** | **-0.019** |
| 6 | **0.640** | **0.600** | **0.620** | **0.625** | **0.015** | **0.610** | **0.640** | **0.01** | **-0.020** |
| 7 | **0.631** | **0.611** | **0.621** | **0.625** | **0.015** | **0.610** | **0.640** | **0.011** | **-0.019** |
| 8 | **0.638** | **0.605** | **0.622** | **0.625** | **0.015** | **0.610** | **0.640** | **0.0115** | **-0.019** |
| 9 | **0.641** | **0.605** | **0.623** | **0.625** | **0.015** | **0.610** | **0.640** | **0.013** | **-0.017** |
| 10 | **0.632** | **0.615** | **0.624** | **0.625** | **0.015** | **0.610** | **0.640** | **0.0135** | **-0.017** |
| 11 | | | #DIV/0! | | 0.015 | -0.015 | 0.015 | #DIV/0! | #DIV/0! |
| 12 | | | #DIV/0! | | 0.015 | -0.015 | 0.015 | #DIV/0! | #DIV/0! |
| 13 | | | #DIV/0! | | 0.015 | -0.015 | 0.015 | #DIV/0! | #DIV/0! |
| 14 | | | #DIV/0! | | 0.015 | -0.015 | 0.015 | #DIV/0! | #DIV/0! |
| 15 | | | #DIV/0! | | 0.015 | -0.015 | 0.015 | #DIV/0! | #DIV/0! |

| OUTSIDE DIA. Permissible +- 0.038 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Tube | highest | lowest | Nominal | Tolerance | min | max | min | max |
| 1 | **0.640** | **0.610** | **0.625** | **0.038** | **0.587** | **0.663** | **0.053** | **-0.053** |
| 2 | **0.640** | **0.605** | **0.625** | **0.038** | **0.587** | **0.663** | **0.053** | **-0.058** |
| 3 | **0.627** | **0.614** | **0.625** | **0.038** | **0.587** | **0.663** | **0.040** | **-0.049** |
| 4 | **0.640** | **0.607** | **0.625** | **0.038** | **0.587** | **0.663** | **0.053** | **-0.056** |
| 5 | **0.632** | **0.610** | **0.625** | **0.038** | **0.587** | **0.663** | **0.045** | **-0.053** |
| 6 | **0.640** | **0.600** | **0.625** | **0.038** | **0.587** | **0.663** | **0.053** | **-0.063** |
| 7 | **0.631** | **0.611** | **0.625** | **0.038** | **0.587** | **0.663** | **0.044** | **-0.052** |
| 8 | **0.638** | **0.605** | **0.625** | **0.038** | **0.587** | **0.663** | **0.051** | **-0.058** |
| 9 | **0.641** | **0.605** | **0.625** | **0.038** | **0.587** | **0.663** | **0.054** | **-0.058** |
| 10 | **0.632** | **0.615** | **0.625** | **0.038** | **0.587** | **0.663** | **0.045** | **-0.048** |
| 11 | | | | 0.038 | -0.038 | 0.038 | 0.038 | -0.038 |
| 12 | | | | 0.038 | -0.038 | 0.038 | 0.038 | -0.038 |
| 13 | | | | 0.038 | -0.038 | 0.038 | 0.038 | -0.038 |
| 14 | | | | 0.038 | -0.038 | 0.038 | 0.038 | -0.038 |
| 15 | | | | 0.038 | -0.038 | 0.038 | 0.038 | -0.038 |

## Eric Downing

**From:** Chris Provencal
**Sent:** Monday, June 03, 2013 10:31 AM
**To:** Eric Downing
**Subject:** RE: extrusion

The tubes are acceptable. The wall thickness mean is within 0.020" and the max eccentricity is within 0.063". Some of the mean O.D. measurements are over tolerance (0.010
-0.011" under nominal), this is acceptable.

-Chris

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**From:** Eric Downing
**Sent:** Friday, May 31, 2013 2:37 PM
**To:** Chris Provencal
**Subject:** extrusion

Hey Chris can you please go over these numbers for this extrusion that arrived this week. Let me know if you are fine with the values.

Thanks

**Eric Downing**
**QC Coordinator**
T: 1-613-632-5200 ext 223
C:1-613-363-9375
F: 1-613-632-5246
www.dartaero.com
Edowning@Dartaero.com